

## **Science Activities**

- A. Sea Level Rise
- B. The Greenhouse Effect
- C. Global Warming Begins at Home
- D. Global Warming Skit
- E. Are Temperatures Changing in Your Community?

## Sea-Level Rise

(See "Climate Detectives" fact sheet.)

Materials: Electric hot plate, heat-resistant 12-ounce tumbler, cake pan, water, ice cubes.

First Part- To Prove That: Water expands when heated. As the earth's atmosphere traps more heat, the oceans will warm and expand - and sea level will rise.

Procedure: Fill the glass with very cold water. Make sure to fill the glass almost to overflowing, so the water is right at the rim's edge. Place the glass in the cake pan, put the pan on the hot plate, and turn the heat to the lowest setting. Wait several minutes. What happens to the water? Does it expand?

Second Part- To Prove That: Ice that is already floating on the ocean does not raise the sea level when it melts. Melting glaciers, however, do raise sea level slightly.

Put two ice cubes in the glass and then fill with water, almost to overflowing. Watch the water level as the ice melts. What happens? Does the water overflow?

After the ice has melted, put another piece of ice in the glass. What happens?

Why would sea level rise from a melting glacier, but not from a melting iceberg?

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## **The Greenhouse Effect**

(See "Check Out the Greenhouse Effect" fact sheet.)

### **Method A**

**Materials:** 1 empty plastic soda bottle (two-liter size) with a cap, nail, two thermometers.

**To Prove That:** A transparent or semitransparent covering traps heat, so gases in the atmosphere trap heat like a greenhouse.

**Procedure:** Both thermometers and the bottle should be outdoors on the ground in full sunlight. Make a hole near the top of the plastic bottle. Place one of the thermometers in the hole. Place the other thermometer outside the bottle, next to it on the ground. Be sure that both thermometers are receiving the same amount of sunlight.

**What happens?** Do both thermometers register the same temperature? If not, which one is higher? **Why?**

### **Method B**

**Materials:** 2 thermometers, use of a car.

**To Prove That:** A transparent covering traps heat, so gases in the atmosphere trap heat like a greenhouse.

**Procedure:** Take the class or group out to the presenter's or teacher's car. Place one of the thermometers in the car. Place the other thermometer outside the car. Be sure that both thermometers are receiving the same amount of sunlight.

**What happens?** Do both thermometers register the same temperature? If not, which one is higher? **Why?**

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## Global Warming Begins at Home

(See "Can We Change the Climate?" fact sheet.)

Note: The following exercise is condensed from "Global Change Education Resource Guide" (Washington, DC: NOAA). Originally, the exercise came from For Earth's Sake: Lessons in Population and the Environment, published in 1989 by Zero Population Growth, Inc.

Materials: Pencils, paper, and data that will help participants calculate approximately how much carbon dioxide one family's activity adds to the atmosphere in a year. The figures can come either from a participant or an outside source.

To Prove That: Everyone contributes to the greenhouse gases in the atmosphere.

Procedure: Have participants answer the questions below:

1. Find out how many miles your family drove in the past year and how many miles per gallon of gasoline the family car gets. (If there is more than one car, get figures for each car.) Divide the miles driven by the miles per gallon to calculate how many gallons of gasoline the family car(s) burned during the year. Each gallon burned produces 20 pounds of carbon dioxide.
2. Find out from the local power company how the electricity used by your family is generated (e.g., whether your local power plant is coal-, oil-, or natural gas-fired or uses hydropower or nuclear energy). On your family utility bills, look up how many kilowatt-hours of electricity were used in your home each month for a year. Each kilowatt-hour of electricity generated in a coal-fired power plant produces 2.11 pounds of carbon dioxide; in an oil-fired plant, 1.73 pounds of carbon dioxide; and in a natural gas-fired plant, 1.18 pounds of carbon dioxide. Hydropower and nuclear do not produce carbon dioxide.
3. Look up how much natural gas was used in your home in the past year. Burning 100 cubic feet of natural gas (1 ccf) produces 12 pounds of carbon dioxide (1 ccf is equal to 1 therm or 100,000 BTUs).
4. Estimate how many miles you and your family members flew on trips for pleasure or business in the past year. Generally, flying one mile in a commercial airplane generates approximately 0.5 pounds of carbon dioxide per passenger.
5. Add the totals for 1 through 4 to calculate your family's direct production of carbon dioxide. Then double that figure to account for the carbon dioxide generated indirectly to produce the goods and services your family uses. (Carbon dioxide is used in the heating and cooling of public buildings you use, etc.)

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## Global Warming Skit

(For young audiences)

Materials: Cardboard or posterboard, string, hole punch, marking pens or crayons in assorted colors.

Procedure: Children will learn about global warming by "acting" out the greenhouse effect. Have kids choose different roles: sun, earth, atmosphere, heat (two), space, cars (two), airplane, and greenhouse gases (three). Each child can use the cardboard or posterboard and marking pens or crayons to create his or her costume.

Suggested Script: (actors will perform actions as they are spoken by the narrator).

"What is the Greenhouse Effect?"

Narrator: What is the greenhouse effect? How does it work? Well, first of all, the sun warms the earth.

Enter sun. Enter earth. Enter two heats. The sun sends both heats toward the earth.

Sun: I'm the sun, and I warm the earth.

Narrator: Without the sun, people wouldn't be able to live here. But too much heat from the sun isn't good, either. The earth sends some heat back into space and that helps keep the earth from getting too hot.

Enter space. One heat goes toward space.

First heat: I'm heat, and I go back into space.

Space: I'm space, and some of the heat comes back into me.

Narrator: Most of the earth's heat is trapped by the atmosphere. Like the glass roof of a greenhouse, the atmosphere keeps most of the heat from going back into space.

Enter atmosphere. The atmosphere traps most of the second heat.

Atmosphere: I'm atmosphere, and I keep most of the heat from going back into space.

Second heat: I'm most of the heat, and I stay in the atmosphere and warm it.

Narrator: The atmosphere contains substances called gases.

Enter greenhouse gases.

Greenhouse gases (three): We're greenhouse gases, and we trap heat from the sun.

Narrator: Some of these gases also trap heat from the sun. Because those gases cause the greenhouse effect, they are called "greenhouse gases." Some greenhouse gases are produced by human activities, like driving and flying.

Enter two cars and plane. The cars "drive" and plane "flies."

Cars: We're cars, and we make greenhouse gases.

Plane: I'm a plane, and I do, too.

Narrator: We make greenhouse gases by using fuels such as gasoline. Fuel is important. We need fuel to drive cars, fly planes, and heat our homes. But when we use fuel, gases go into the air and add to the effect of the greenhouse. The greenhouse effect helps to warm the earth.

Greenhouse gases follow cars and then move toward the atmosphere. Now, when the heat moves toward the atmosphere, it's trapped by the greenhouse gases.

Greenhouse gases: We go into the atmosphere, and we trap the heat when it comes up to the atmosphere.

All: We help make the greenhouse effect!

## **Are Temperatures Changing in Your Community**

To initiate a classroom activity, we suggest that you compile a long-term temperature record from your community - just the temperatures and dates (annual or by decade). Distribute copies of the record to the students, and ask them to create a graph based on the record. They can label years (or decades) on the x (or horizontal) axis and degrees on the y (or vertical) axis - and then they can plot the temperature record that you've given them. In doing so, they'll create a very simple way to track long-term changes in temperature right in their own community.

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